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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of — Atty. Docket

GERARD DE HAAN ET AL. — PHNL 000643

Serial No.: 09/913,670 — Group Art Unit: 2613

Filed: August 17, 2001 — Examiner: Shawn S. An

Title: ESTIMATION OF MOVEMENTS IN VIDEO IMAGES

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Enclosed is an original copy of an Appeal Brief in the above-identified patent application.

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Respectfully submitted,

By _____
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By Lynette James
(Signature)

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APPEAL BRIEF

This is an appeal from the Examiner of Group 2613 finally rejecting claims 1-5 and 7 in this application.

(i) Real Party in Interest

The real party in interest in this application is U.S. PHILIPS CORPORATION by virtue of an assignment from the inventors recorded on August 17, 2001, at Reel 012220, Frame 0076.

(ii) Related Appeals and Interferences

There are no other appeals and/or interferences related to this application.

(iii) Status of the Claims

Claims 1-5 and 7 stand finally rejected by the Examiner. Claim 6 was withdrawn (based on an unelected species). Applicants are appealing the final rejection of claims 1-5 and 7.

(iv) Status of Amendments

There was one (1) Response filed on January 20, 2005, after final rejection of the claims on December 28, 2004, which was considered by the Examiner.

(v) Summary Of Claimed Subject Matter

The subject invention relates to motion estimation in video signals in which two or more motion models are used to describe the displacement of image objects between a current and a previous video image. As described in the Substitute Specification on page 3, line 23 to page 4, line 13 (paragraph [0007]), since it is not clear, in advance, which motion model is to be assigned to which image area and with which parameter set, the selection criterion is initially used with all motion models for the same image areas.

The subject invention seeks to simplify the amount of calculations needed to be performed. As described in the Substitute Specification on page 4, lines 21-24, only those parts of the image area in which the first video image is significantly distinguished

from the second video image are taken into account for determining the parameter sets. This is effectively illustrated in Fig. 1 and described in the Substitute Specification on page 12, lines 16-23 (paragraph [0029]). In particular, Fig. 1 shows a video image 1 of a person riding a motorcycle 2 moving from left to right on a street 3. The background (and the street 3) is stationary, which the motorcycle is in motion. By comparing various areas of the image frame of a current image and a previous image, "interesting" image areas can be distinguished and are indicated by white blocks 4.

The method of the present invention, as claimed in claim 1, finds support in the Substitute Specification on page 5, line 18 to page 6, line 9 (paragraph [0011]), on page 12, line 24 to page 13, line 15 (paragraph [0030]), and in Fig. 2, wherein the selecting step is shown as step 9 in which a current video image 7 is compared with a previous video image 6 to determine the interesting image areas. These image areas are processed in step 11 to determine the parameters of the motion models. Fig. 2 also shows a threshold 8 being applied in step 9. This threshold 8, as claimed in claim 2, is used for determining interesting image areas in which the deviation between the current image and the previous image exceeds the threshold. This is described, in detail, in the Substitute Specification on page 12, lines 3-15 (paragraph [0028]).

The device of claim 5, is described in the Substitute Specification on page 6, line 24 to page 7, line 14 (paragraph [0014]), on page 13, line 16 to page 14, line 3 (paragraph [0031]), and in Fig. 3. In particular, an image memory 22 receives the video signal 20 as input to a digital image processing unit 21. Therein, a processor 23 performs the image processing method according to the invention, i.e., the current and previous images are compared to select significantly distinguished parts of the image frame (9 in Fig. 2), and parameter sets of two or more motion models are determined for these selected parts (11 in Fig. 2).

Claim 7 claims a computer program product for use in, for example, the processor 23 of Fig. 3, and is described in the Substitute Specification on page 8, lines 10-22 (paragraph [0016]).

(vi) Grounds of Rejection to be Reviewed on Appeal

(A) Whether the invention, as claimed in claims 1 and 4, is anticipated by U.S. Patent 5,450,133 to Herpel et al., under 35 U.S.C. 102(b).

(B) Whether the invention, as claimed in claims 2, 3 and 5, is unpatentable over Herpel et al. in view of International Patent Application No. WO 99/16251 to De Haan et al., under 35 U.S.C. 103(a).

(C) Whether the invention, as claimed in claim 7, is unpatentable over Herpel et al. in view of U.S. Patent 5,933,535 to Lee et al., under 35 U.S.C. 103(a).

(vii) Arguments

(A) The Herpel et al. patent discloses motion compensated adaptive vertical filtering of an image representative signal in which a motion parameter generator generates picture-by-picture motion parameters for a pair of pictures from the block-by-block motion parameters originating from a coder 15. In a format converter 14, picture signals from a line memory 13 are motion compensated by the picture-by-picture motion parameters and are coupled to a frame memory 22 which also receives picture signals delayed by one field. The output of the frame memory contains frame signals with maximum vertical local resolution.

The subject invention concerns motion estimation in which, in determining the parameter sets, only those parts of the image frame are taken into account in which the first video image is significantly distinguished from the second video image. To that end, as claimed in claim 1, the subject invention includes "selecting parts of an image frame in which a first video image is significantly distinguished from a second video image", and "determining, in the selected parts in the first and second video images, parameter sets of two or more motion models", and as

claimed in claim 4, the subject invention further includes "of the selected parts, those parts of the image area in which motion was determined in previous video image data of a sequence of video images, are taken into account for determining the parameter sets."

It has been well established that "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Appellants submit that Herpel et al. neither shows nor suggests each and every element as set forth in the claim. In particular, in rejecting claims 1 and 4, the Examiner paraphrases the wording in the claims and cites Fig. 2, elements 22 and 24, and col. 2, lines 51-55, as disclosing these limitations. However, element 22, as noted above, is a frame memory, while element 24 is an input to motion compensation circuit 23 which carries the picture-by-picture motion parameters from the motion parameter generator 16.

Further, the passage in Herpel et al. cited by the Examiner (i.e., col. 2, lines 51-55) states:

"A motion parameter generator 16 generates picture-by-picture motion parameters pn-1 for a pair of pictures sn-2, sn-1 (z, vx, vy) from the block-by-block motion parameters, for example, for zoom and pan, originating from coder 15."

Appellants submit that it should be clear that these components of Herpel et al., nor any other components of Herpel et al., perform the steps "selecting parts of an image frame in which a first video image is significantly distinguished from a second video image", and "determining, in the selected parts in the first and a second video images, parameter sets of two or more motion models", as claimed in claim 1, nor, as claimed in claim 4, "of the selected parts, those parts of the image area in which motion was determined in previous video image data of a sequence of video images, are taken into account for determining the parameter sets."

The Examiner now states:

> "... Herpel et al discloses selecting parts of an image frame in which a first video image (20) is significantly distinguished from a second video image (23), and determining, in the selected parts in the first and second video image parameter sets of at least two motion models (16), wherein those selected parts of the image area in which motion was determined in previous video image data of a sequence of video images (col. 2, lines 51-55, col. 4, lines 21-51).
>
> "Note: The Examiner considers the first video image to be significantly distinguished from a second video image (inherency emphasized) because the second video image is a motion compensated image, thereby inherently distinguished from the first video image without any motion compensation. Further note that a motion between two video images creates a significant difference."

From the above, it should be apparent that the Examiner does not understand the subject invention. In particular, the Examiner is looking at the first and second video images in toto, as opposed to parts of the image frame. In particular, when comparing parts of an image frame in a current image with the same

parts of the image frame in a previous image, even though there may be motion between the two images, there will nonetheless be areas where there is no motion (see, for example, Fig. 1 of the drawings and the description in the Substitute Specification at page 12, paragraph [0029] (described above), in which the street and the background exhibit no motion between the previous and current images). The subject invention seeks to reduce the complexity of the motion compensation by eliminating the areas where there is little or no difference between the previous and current images and, presumably, little or no motion, and only performing the determining of the parameter sets of two or more motion models for those areas which show significant differences between the previous and current images. It should be understood that in the prior art, as well as in Herpel et al., the determining of the parameter sets is performed on the whole of the images, i.e., each block in a block-by-block without regard to whether it is, in fact, needed.

Further, the Examiner appears to be looking at a motion compensated image as compared to an uncompensated image. This does not make any sense. The subject invention is comparing a current input video image with a previous input video image, both of which have not had motion compensation.

The sections of Herpel et al. pointed out by the Examiner state:

> "A motion parameter generator 16 generates picture-by-picture motion parameters pn-1 for a pair of

pictures sn-2, Sn-1 (z, vx, vy) from the block-by-block motion parameters, for example, for zoom and pan, originating from coder 15."

and

"FIG. 2 shows picture format converter 14 in more detail. A first input 20 is connected to a frame memory 22 and receives picture signals delayed by one field from the respective first field from field memory 12. A second input 21 is connected to a motion-compensation circuit 23 and receives line-delayed picture signals from the respective second field from line memory 13. A third input 24 is also connected to the motion-compensation circuit and receives motion parameters from motion parameter generator 16. A fourth input 27 receives output signals from alteration detector 17.

"Picture signals from line memory 13 are motion-compensated by picture-by-picture motion parameters from the motion parameter generator according to known methods, and are coupled to frame memory 22. The lines in the line memory can be addressed via output 211. Frame signals with maximum vertical local resolution are now present at the output of the frame memory. These signals are filtered by subsequent vertical filter 25, one picture element after another, corresponding to the signal at the fourth input 27 in the frame or field, and are also coupled via output 26 to alteration detector 17.

"A sub-sampling stage 28 is connected downstream from the vertical filter, and picture signal sn can be acquired at output 29 of sub-sampling stage 28.

"The picture-by-picture motion parameters may contain zoom and/or pan factors applicable to a complete picture, or image translating vectors for sections within the pictures. For example an image translating vector may be formed for picture element blocks of 8*8 picture elements."

Appellants submit that it should be clear that there is no "selecting parts of an image frame in which a first video image is significantly distinguished from a second video image" and then ""determining, in the selected parts in the first and a second video images, parameter sets of two or more motion models".

Further, with regard to claim 4, since there is no "determining, in the selected parts", then surely, there cannot be any "of the selected parts, those parts of the image area in which motion was determined in previous video image data of a sequence of video images, are taken into account for determining the parameter sets."

(B) The above arguments concerning Herpel et al. are incorporated herein.

The De Haan et al. patent discloses motion estimation and motion-compensated interpolation, in which input fields of a video signal are applied to a plurality of parameter estimators for determining motion parameters, and in which to simplify the input to the parameter calculation means, the parameter vector is selected from a number of candidate parameter vectors as the one that has the minimal value of a match criterion.

(1) Claim 2

The subject invention, as claimed in claim 2, defines the selecting step of claim 1 as "dividing a current and a previous video image into respective pluralities of blocks", and "evaluating deviations between the current and the previous video image block by block, taking those blocks as said selected parts in which the a value of the deviation exceeds a predetermined threshold value". It

should be note that this portion of the invention has nothing to do with motion compensation or motion estimation. Rather, this portion of the invention merely selects those parts of the video image for which the subsequent motion estimations is to be performed.

Appellants submit that while De Haan et al. teaches motion estimation, De Haan et al. neither shows nor suggests "evaluating deviations between the current and the previous video image block by block". Rather, De Haan et al. evaluates the candidate parameter vectors and selects the one that has the minimal value of a match criterion calculated in accordance with a given formula. Nowhere in De Haan et al. is it shown or suggested that deviations between a current and previous image blocks should be evaluated. Rather, De Haan et al. evaluates the parameter vectors being generated by the parameter estimators.

It is important to understand that the predetermined threshold value as claimed in claim 2 relates to the amount that an image area differs between the current and previous video images. While De Haan et al. "mentions" threshold, this threshold relates the value of a local match error of another adjusted motion parameter set determination. There is no way that the threshold mentioned in De Haan et al. could possibly relate to the threshold as claimed in claim 2.

(2) Claim 3

The present invention as claimed in claim 3, further limits claim 2, in that "the threshold value is based on the condition that the number of image areas taken into account for determining the parameter sets is limited to a predeterminable value".

The Examiner now states "Herpel et al does not particularly disclose the threshold value being based on the condition that the number of image area taken into account for determining the parameter sets is limited to a predetermined value. However, Herpel et al. discloses the number of image area taken into account (block by block) for determining the parameter sets (col. 2, lines 51-55), and De Haan et al teaches determining the parameter sets based on the threshold value. Furthermore, a threshold value is normally a predetermined value."

Herpel et al. discloses generating picture-by-picture motion parameters from the block-by-block motion parameters (col. 2, lines 51-55). However, there is no disclosure in Herpel et al. or in De Haan et al. of limiting the number of image areas to a predetermined number, and that the threshold value, concerning the deviation of the current and previous image, should be based on this condition.

(3) Claim 5

Claim 5 is an independent claim and claims a device for motion estimation. The elements claimed in claim 5 include "a digital image memory for storing a current and a previous video image", "means for block-wise evaluating deviations between the current and the previous video image, and for selecting those blocks of the current and previous video images in which the value of the deviation exceeds a predeterminable threshold value" and "means for determining parameter sets of two or more motion models in accordance with a selection criterion based on said selected blocks".

The only part of this claim which Appellants concede is shown in Herpel et al. and/or De Haan et al. is the digital memory (Herpel et al., Fig. 2, Ref. 22). With regard to the second limitation of claim 5, i.e., "means for block-wise evaluating deviations between the current and the previous video image, and for selecting those blocks of the current and previous video images in which the value of the deviation exceeds a predeterminable threshold value", the Examiner again cites Fig. 1, item 16, and col. 2, lines 51-55.

As Appellants had explained previously, element 16 of Herpel et al. is a motion parameter generator which "generates picture-by-picture motion parameters pn-1 for a pair of pictures sn-2, Sn-1 (z, vx, vy) from the block-by-block motion parameters,

for example, for zoom and pan, originating from coder 15." There is no disclosure or suggestion of block-wise evaluating deviations between a current and a previous image, and for selecting blocks in which the deviation exceed a predetermined threshold.

The Examiner concedes that Herpel et al. does not specifically disclose this limitation, but states that De Haan et al. teaches this specific limitation, and references page 7, line 7-20, and page 30, lines 8-11.

Appellants submit that this is incredible! De Haan et al. on page 7, lines 7-20 is merely describing a block-based estimator, while on page 30, lines 8-11, claim 6 states "wherein for a given adjusted motion parameter set determination (PEi), said weights are decreased for those image parts for which the local match error of another adjusted motion parameter set determination (PE1-PEn) falls below a given threshold." The only thing in common between this section of De Haan et al. and the limitation in claim 5 is the term "threshold". However, the threshold in claim 5 relates to an amount by which a block in the current image differs from a block in the previous image, wherein when the deviation exceeds the threshold, the block is selected for the determination of the parameter sets. In De Haan et al., the threshold relates to the match error of adjusted motion parameter set determination.

(C) The above arguments concerning Herpel et al. are incorporated herein.

The Lee et al. patent discloses object-based video compression process employing arbitrarily-shaped features, in which a computer 20 has resident software for arguably performing motion estimation. However, Appellants submit that Lee et al. does not supply that which is missing from Herpel et al., i.e., block-wise comparing the video data of the first and second video images and selecting those blocks exhibiting significant differences between the first and second video images, and computing parameter sets of two or more motion models and supplying motion data describing the displacement of image objects from the previous to the current image based on the selected blocks.

Based on the above arguments, Appellants believe that the subject invention is not rendered obvious by the prior art and is patentable thereover. Therefore, Appellants respectfully request that this Board reverse the decisions of the Examiner and allow this application to pass on to issue.

Respectfully submitted,

by _____
Edward W. Goodman, Reg. 28,613
Attorney

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On May 4, 2005

By Barrett James

(viii) Appendix


CLAIMS ON APPEAL

1. (Previously Submitted) A method of motion estimation in video image data, said method comprising the steps:

selecting parts of an image frame in which a first video image is significantly distinguished from a second video image; and

determining, in the selected parts in the first and a second video images, parameter sets of two or more motion models.

2. (Previously Submitted) The method as claimed in claim 1, characterized in that said selecting step comprises:

dividing a current and a previous video image into respective pluralities of blocks;

evaluating deviations between the current and the previous video image block by block, taking those blocks as said selected parts in which a value of the deviation exceeds a predetermined threshold value.

3. (Previously Submitted) The method as claimed in claim 2, characterized in that the threshold value is based on the condition that the number of image areas taken into account for determining the parameter sets is limited to a predeterminable value.

4. (Previously Submitted) A method as claimed in claim 1, characterized in that of the selected parts, those parts of the image area in which motion was determined in previous video image data of a sequence of video images, are taken into account for determining the parameter sets.

5. (Previously Submitted) A device for motion estimation in video image data, the device comprising:

a digital image memory for storing a current and a previous video image;

means for block-wise evaluating deviations between the current and the previous video image, and for selecting those blocks of the current and previous video images in which the value of the deviation exceeds a predeterminable threshold value; and

means for determining parameter sets of two or more motion models in accordance with a selection criterion based on said selected blocks.

6. (Withdrawn) A device for displaying video images, particularly a television or a monitor, comprising a digital image memory (22) in which video image data can be stored, and electronic means (21, 25) for processing the image data stored in the image memory and for displaying video images on a display device (28),

the means (21) for processing the image data comprising means for determining parameter sets of two or more motion models in accordance with a selection criterion, characterized in that the means (21) for processing the image data further comprise means for block-wise evaluation of the deviations between the current and the previous video image and for selection of those blocks for use of the selection criterion, in which the value of the deviation exceeds a predeterminable threshold value.

7. (Previously Submitted) A computer program product for motion estimation in video image data, said computer program product receiving, as input, a first and a second video image, said computer program product block-wise compares the video data of the first and second video images and selects those blocks exhibiting significant differences between the first and second video images, and said computer program product computes parameter sets of two or more motion models and supplies motion data describing the displacement of image objects from the previous to the current image based on the selected blocks.